CLAIMS

We claim :

1. A direct current motor comprising:

a stator with 2P poles;

a rotor core, including a core of ferromagnetic material having S slots and S teeth separated from the stator core by an airgap;

a commutator with a number of segments greater than the number of rotor slots S;

a concentrated winding rotor, having a plurality of simple coils of insulated wire mounted on the same rotor tooth, with the terminals of these coils being connected to different segments of the commutator.

2. The direct current motor as in claim 1, wherein each pole comprises a permanent magnet mounted on the surface of a core of a ferromagnetic material.

3. The direct current motor as in claim 1, wherein each pole comprises a coil wound around a tooth made of a ferromagnetic material.

4. An AC commutator (Universal) motor comprising:

a stator with 2P poles, each pole comprising a coil wound around the tooth of a core of a ferromagnetic material;

Sub B5 cancel.

a rotor core including a core of ferromagnetic material having S slots and S teeth separated from the stator core by an airgap, the stator and rotor core comprising a magnetic circuit;

a commutator with a number of segments Z bigger than the number of rotor slots S;

a concentrated winding rotor having a plurality of simple coils of insulated wire mounted on the same rotor tooth, with the terminals of these coils being connected to different segments of the commutator.

5. A direct current motor comprising:

a stator with 2P poles;

a rotor core including a core of ferromagnetic material having S slots and S teeth separated from the stator core by an airgap;

a rotor core having a plurality of teeth, each tooth having the same geometrical dimensions:

a concentrated winding rotor with a plurality of coils of insulated wire being wound around each rotor tooth;

a commutator with a number of segments Z;

wherein the number of stator poles 2P, the number of rotor slots S and the number of segments on the commutator Z satisfy the following conditions:

P is an integer and	$0 < P < 10$
$S = 2P + A$	A is an integer equal to −1 or 1 or 2 or 3 or 4
$S > 2$	
$Z = k*LCM(S,2P) \pm n$	k is an integer greater than 0
	LCM is the Least Common Multiple of S and 2P
	n is equal to 0 or k

or $Z = LCM(S,2P)/2$ and $Z/2P > 3$

6. The direct current motor of claim 5, wherein each pole comprises a permanent magnet mounted on the surface of a core of a ferromagnetic material.

7. The direct current motor of claim 5, wherein each pole comprises a coil wound around a tooth made of a ferromagnetic material.

8. An AC commutator (Universal) motor comprising:
a stator with 2P poles, each comprising a coil wound around the tooth of a core of a ferromagnetic material;

a rotor core including a core of ferromagnetic material having S slots and S teeth separated from the stator core by an airgap, wherein each tooth has the same geometrical dimensions;

a concentrated winding rotor having a plurality of insulated wire coils being wound around each rotor tooth;

a commutator with a number of segments Z;

wherein the number of stator poles 2P, the number of rotor slots S and the number of segments on the commutator Z satisfy the following conditions:

P is an integer and $0 < P < 10$

$S = 2P + A$ A is an integer equal to −1 or 1 or 2 or 3 or 4

$S > 2$

$Z = k*LCM(S,2P) \pm n$ k is an integer greater than 0

LCM is the Least Common Multiple of S and 2P

n is equal to 0 or k

or $Z = LCM(S,2P)/2$ and $Z/2P > 3$

9. A direct current motor comprising:

a stator with 2P poles;

a rotor core including a core of ferromagnetic material having S lots and S teeth separated from the stator core by an airgap;

wherein S/2 of the teeth have different geometrical dimensions from the remaining teeth;

a concentrated winding rotor having a plurality of coils of insulated wire being wound around S/2 of the rotor teeth;

a commutator with a number of segments Z;

wherein the number of stator poles 2P, the number of

rotor slots S and the number of segments on the commutator Z to satisfy the following conditions:

P is an integer and $1 < P < 10$
$S = 2P + 2A$ A is an integer and $1 < A < P$
$Z = k*LCM(S/2,2P) \pm n$ k is an integer greater than 0

LCM is the Least Common Multiple of S/2 and 2P

n is equal to 0 or k

or $Z = LCM(S/2,2P)/2$

10. The direct current motor as in claim 9, wherein each pole comprises a permanent magnet mounted on the surface of a core of a ferromagnetic material.

11. The direct current motor as in claim 9, wherein each pole comprises a coil wound around a tooth made of a ferromagnetic material.

12. An AC commutator (Universal) motor comprising:

a stator with 2P poles;

a rotor core including a core of ferromagnetic material having S slots and S teeth separated from the stator core by an airgap,

wherein S/2 teeth have different geometrical dimensions from the remaining teeth;

a concentrated winding rotor having a plurality of coils of insulated wire being wound around S/2 rotor teeth;

a commutator with a number of segments Z;

wherein the number of stator poles 2P, the number of rotor slots S and the number of segments on the commutator Z to satisfy the following conditions:

P is an integer and $1 < P < 10$

$S = 2P + 2A$ A is an integer and $1 < A < P$

$Z = k*LCM(S/2,2P) \pm n$ k is an integer greater than 0

LCM is the Least Common Multiple of S/2 and 2P

n is equal to 0 or k

or $Z = LCM(S/2,2P)/2$

13. The AC commutator (Universal) motor as in claim 12, wherein each pole comprises a permanent magnet mounted on the surface of a core of a ferromagnetic material.

14. The AC commutator (Universal) motor as in clam 12, wherein each pole comprises a coil wound around a tooth made of a ferromagnetic material.

15. A direct current motor as claimed in claim 1 with a part of the magnetic circuit realized with a soft magnetic composite made of metal powder.

16. A direct current motor as claimed in claim 15, wherein the center part of the rotor or stator teeth under the coils have a rounded, oval, or circular profile, whereby to reduce the risk of destruction of the insulation by a sharp bending of the winding coils, and to maximize the copper filling factor.

17. A direct current motor as claimed in claim 15 wherein:

the axial lengths of the center part of the teeth under the coils and the yoke are the same;

the axial length of the tooth tips is higher than the axial length of the teeth.

18. A direct current motor as claimed in claim 17 wherein the end-windings are inserted partially or completely under the tooth tips.

19. A direct current motor as claimed in claim 17 wherein the commutator and brushes are partially or completely inserted under the rotor tooth tips to reduce the total axial length of the motor.

20. A direct current motor as claimed in claim 15 wherein the teeth are not skewed and some tooth tips are

skewed to reduce the variations of the magnetic reluctance or the cogging torque.

21. An AC commutator (Universal) motor as claimed in claim 4, wherein a part of the magnetic circuit is realized with a soft magnetic composite made of metal powder.

22. An AC commutator (Universal) motor as claimed in claim 21, wherein the center part of the rotor or stator teeth under the coils have a rounded, oval, or circular profile whereby to get a reduction of the risk of destruction of the insulation by a sharp bending of the winding coils, and to maximize the copper filling factor.

23. An AC commutator (Universal) motor as claimed in claim 21, wherein:

the axial lengths of the center part of the teeth under the coils and the yoke are the same;

the axial length of the tooth tips is higher than the axial length of teeth.

24. An AC commutator (Universal) motor as claimed in claim 23, wherein the end-windings are inserted partially or completely under the tooth tips.

25. An AC commutator (Universal) motor as claimed in claim 23, wherein the commutator and brushes are partially or completely inserted under the rotor tooth tips to reduce the total axial length of the motor.

26. An AC commutator (Universal) motor as claimed in claim 21, wherein the teeth are not skewed and some tooth tips are skewed to reduce the variations of the magnetic reluctance or the cogging torque.

27. The direct current motor as in claim 1, wherein a plurality of equalizer connections are added on the commutator to reduce the number of brushes.

28. An AC commutator (Universal) motor as in claim 4, wherein a plurality of equalizer connections are added on the commutator to reduce the number of brushes.